REMARKS

This application is amended in a manner to place it in condition for allowance at the time of the next Official Action.

Status of the Claims

Claims 27-32 and 45 are amended.

Claims 53 and 54 are new and are directed to the elected subject matter.

Support for the amendment may be found generally throughout the specification and the original claims.

Claims 27-54 remain in this application.

Claims 33-44 and 46-52 have been withdrawn as being directed to non-elected subject matter.

Objections

The specification was objected to for including improper scientific notation.

The values of the numbers " 3.10^{3} ", "3.10^{6} ", " 2.10^{-11} ", "2.10^{-9} " were determined to be unclear. Accordingly, the specification has been amended to utilize proper scientific notation for these numbers, i.e., " 3×10^{3} ", "3×10^{6} ", " 2×10^{-11} " and "2×10^{-9}", respectively.

Claim 45 was objected to for being dependant on withdrawn claim 37. The Official Action stated that dependency of claim 45 should be corrected, or the claim should be amended to a

proper independent form. Accordingly, claim 45 is amended into an independent form.

Therefore, withdrawal of these objections is respectfully requested.

Claim Rejections-35 USC §112, 1st paragraph

Claims 31 and 32 were rejected under 35 U.S.C. §112, first paragraph, for both (1) not complying with the written description requirement and (2) not complying with the enablement requirement. This rejection is respectfully traversed for the reasons below.

1) Written description requirement

The Official Action considered the expression "*P is an effective group*" to lack adequate description.

Previously presented claim 31 recited:

"*…P is an effective group allowing spectroscopic detection of said functionalized carbon nanotube, such as a fluorophore, such as FITC, or an active molecule, liable to induce a biological effect, chosen among a peptide, a pseudopeptide, a protein, such as an enzyme or an antibody, a nucleic acid, a carbohydrate, or a drug...*".

The specification discloses:

"*The expression "P is an effective group" means that P is a group which can confer new physical, chemical or biological properties to the carbon nanotube which carries it.*" (page 10)

"*The expression "P is capable of allowing a spectroscopic detection of the carbon nanotubes" of the invention means that P is a group such as a chromophore capable of being identified by spectroscopic techniques, such as fluorescence*

microscopy, or nuclear magnetic resonance or FTIR (Fourier Transformed Infra-Red) spectroscopy.

The expression "active molecule liable to induce a biological effect" means that said molecule is able to modify the processes of a given biological system by establishing specific interactions with components of said biological system". (page 11).

One of ordinary skill in the art would have understood that the P group confers new properties to the carbon nanotube that carries it. It is further specified that these new properties allow the spectroscopic detection of the said functionalized carbon nanotube, or establishing biological interaction.

The skilled artisan would have been fully aware of the new properties since they were taught in claim 31.

The Official Action recognized that the specification provided examples of suitable structures for the P groups.

The skilled artisan would have known the group that may induce spectroscopic properties, as several examples of these groups were taught in claim 31.

Further, *SEARS, ROEBUCK & Co.* (308 F.2d 705 135 U.S.P.Q. 149) states:

*"35 U.S.C. 112 provides that '*** The specification shall contain a written description of the invention, and of the manner and process of making and using it,***.' But this does not require a description of all the variations which might suggest themselves to one versed in the art." (Paragraph 13).*

Thus, one of ordinary skill in the art would have been taught the new properties, which group may be used to achieve the new properties, and all the variations which may be implicitly taught, but not explicitly written in the description.

Therefore, withdrawal of the written description rejection is respectfully requested.

2) Enablement requirement

The Official Action rejected claims 31 and 32, referring to the low amount of knowledge in the prior art, and the limited guidance and/or working examples provided in the specification.

Specifically, the "*effective group*" recited in claim 31 was considered to lack enablement.

The Official Action noted:

"[…] *the skilled artisan would be burdened with undue experimentation when tasked with finding the "effective group(s)" of the instantly claimed invention.*" (Official Action, page 9)

However, Applicants respectfully disagree for the following reasons:

Claim 31 is drawn to a carbon nanotube potentially having a P group, said P group being identifiable by spectroscopic techniques, or being able to interact with components of biological system.

The Official Action noted that the relative level of skill possessed by one of ordinary skill in the art to be a Master degree or a Doctorate degree.

According to this level of knowledge, this skilled artisan would have been familiar with spectroscopic detection techniques and would have known the kind of groups which allow

spectrometric detection. The artisan would not have required a list of all the compounds that may be detectable using spectrometric techniques.

The artisan would have been able to determine the kind of compound adapted to the desired type of detection technique.

The skilled artisan with a level of knowledge, considering a biological system, would have been able to identify the potential target for interaction and to select the best suited P group to interact with the said target. The artisan would not have required a list of all peptides, proteins, nucleic acids, carbohydrates, drug, or other compounds liable to induce biological effects.

Further, the case *Charles T. FUETTERER* (319 F.2d 259) refers to a rubber stock for producing tire treads. Said rubber stock also contains inorganic salt capable of holding a mixture of carbohydrate and protein in colloidal suspension in water.

Claims were rejected for "undue breadth" placing emphasis on "undue burden upon the public to determine what salt are suitable for obtaining the desired result" (paragraph 36)

In this case the United States Court of Customs and Patent Appeals estimates:

"The only "undue burden" which is apparent to us in the instant case is that which the Patent Office has attempted to place on the appellant. The patent Office would require him to do research on the literally thousands" of inorganic salts and determine which of these are suitable for incorporation into the claimed combination, apparently forgetting that he has not invented, and is not claiming, colloid suspending agents but tire

tread stock composed of a combination of rubber and other ingredients" (paragraph 38).

The present application is drawn to a carbon nanotube potentially having a P group, said P group being identifiable by spectroscopic techniques, or being able to interact with components of biological system.

The invention is not drawn to a new chemical group allowing spectroscopic detection, or a new chemical group able to interact with components of biological system.

Therefore, withdrawal of the enablement rejection is respectfully requested.

Claim Rejections-35 USC §112, 2nd paragraph

Claims 29-32 were rejected under 35 U.S.C. §112, second paragraph, for being indefinite. This rejection is respectfully traversed for the reasons below.

Specifically, claims 29-32 are rejected for improper Markush language. Accordingly, claims 29, 31 and 32 are amended to comply with the suggestion of the Examiner.

Claims 30 - 32 were rejected for reciting improper scientific notation, i.e., " 3.10^{3} ", "3.10^{6} ", " 2.10^{-11} ", "2.10^{-9} ". Accordingly, as amended in the specification, numbers " 3.10^{3} ", "3.10^{6} ", " 2.10^{-11} " and "2.10^{-9}" are now recited as " 3×10^{3} ", "3×10^{6} ", " 2×10^{-11} " and "2×10^{-9}", respectively.

Claims 31 - 32 were also rejected for being unclear with respect to the metes and bounds of "*effective groups*", "*derived from a reactive group*", and "*liable to be linked to*". These expressions are discussed in detail below:

effective groups

Amended claim 31 recites:

"*P is an effective group allowing spectroscopic detection of said functionalized carbon nanotube, or an active molecule, liable to induce a biological effect.*"

The specification discloses:

"*The expression "P is an effective group" means that P is a group which can confer new physical, chemical or biological properties to the carbon nanotube which carries it.*

The expression "P is capable of allowing a spectroscopic detection of the carbon nanotubes" of the invention means that P is a group such as a chromophore capable of being identified by spectroscopic techniques, such as fluorescence microscopy, or nuclear magnetic resonance or FTIR (Fourier Transformed Infra-Red) spectroscopy.

The expression "active molecule liable to induce a biological effect" means that said molecule is able to modify the processes of a given biological system by establishing specific interactions with components of said biological system." (page 10 line 3, to page 11 line 7)

Thus, the one of ordinary skill in the art would have understood that an "effective group" is a molecule having spectroscopic or biological properties.

derived from a reactive group

The specification discloses:

"*The expression "Y is derived from a reactive group" means that Y is a heteroatom or a functional group which has been modified by a chemical reaction generating a new covalent bond.*

It is clear from the preceding description, that -O- is derived from the reactive group -OH, -NH is derived from the

reactive group -NH2, -COO- is derived from the reactive group -COOH, -S- is derived from the reactive group -SH, -CH = and -CH_2- are derived from the reactive group -CHO, -$CC_kH_{2k+}1$ and -CHC_kH_{2k+1}- are derived from the reactive group: ketone, and in particular -CCH_3= and -$CHCH_3$- are derived from the reactive group -$COCH_3$.

As to the azide, it is a protected group.

As to the halide, the corresponding derived group can be -NH-, -O-, -S-, -COO-, or an azide." (page 7, line 11-22).

Thus, the one of ordinary skill in the art would have understood that a Y group is the group remaining after the chemical reaction of a reactive group. Examples are provided.

liable to be linked to

The claims recite:

"[…] *Z is a linker group, liable to be linked to a P group*, […]"

and

"*liable to be linked to*" is not defined in the specification.

However, Z is a chemical group, examples of the structure are provided, and the P group is a molecule having spectroscopic or biological properties.

Thus one of ordinary skill in the art would have understood that "*liable to be linked to*" refers to the possibility to create a chemical bound between two molecules.

Level of skills

The Official Action considered the relative level of skill possessed by one of ordinary skill in the art to be a Master degree or a Doctorate degree.

Exxon Research

Exxon Research and Engineering Company (265 F.3d 1371) states:

"*If the meaning of the claim is discernible, even though the task may be formidable and the conclusion may be one over which reasonable persons will disagree, we have held the claim sufficiently clear to avoid invalidity on indefiniteness grounds.*" (paragraph 23)

The metes and bounds of the claims, although it might require a formidable task, can be conceived in their full scope by one of ordinary skill in the art. Thus, claim 31 is sufficiently clear.

Claims 31-32 were further rejected for reciting the phrases "*such as*" and "*in particular*". Accordingly, claims 31 and 32 are amended to comply with the suggestion of the Examiner.

Therefore, the claims 29-32 are definite and withdrawal of the rejection is respectfully requested.

Claim Rejections-35 USC §102

Claims 27-32 and 45 were rejected under 35 U.S.C. §102(a) as being anticipated by GEORGAKILAS et al. (Chem. Comm. 2002). This rejection is respectfully traversed for the reasons below.

MPEP 706.02(a) II c states: *"For 35 U.S.C. 102(a) to apply, the reference must have a publication date earlier in time than the effective filing date of the application, and must not be applicant's own work."*

The Applicants of the present application are: Bianco Alberto, Pantarotto Davide and Prato Maurizio. All the Applicants are co-authors of the document GEORGAKILAS et al. (Chem. Comm. 2002).

Thus, GEORGAKILAS et al. (Chem. Comm. 2002) includes applicant's own work, and is not eligible as prior art.

Therefore, withdrawal of the rejection is respectfully requested.

Claims 27-32 and 45 were rejected under 35 U.S.C. §102(b) as being anticipated by GEORGAKILAS et al. (JACS 2002). This rejection is respectfully traversed for the reasons below.

Mr. Maurizio Prato, co-author of the article Georgakilas *et al*. (JACS 2002), is an applicant in the present application.

The position of the Official Action was that GEORGAKILAS et al. (JACS 2002) disclose their approach to carbon nanotube functionalization, their methodology, and the reaction products of scheme 1 (page 760).

However, Applicants respectfully disagree, especially with respect to the teaching of a) a reactive and/or activable functional group and b) a capping group for the reasons below:

a) reactive and/or activable functional group

The present application is drawn to functionalized carbon nanotubes, carrying covalently bound reactive and/or activable functional groups.

The document GEORGAKILAS et al. (JACS 2002) does not disclosed carbon nanotubes, carrying covalently bound reactive and/or activable functional groups.

According to GEORGAKILAS et al. (JACS 2002), the compounds disclosed in scheme 1 represent R as:

- an alkyl group (compound (4), R_1),
- an ethylene glycol chain (compounds (3), (4) & (6), R_1),
- a 4-methoxybenzaldehyde (compound (5), R_2), and
- a pyrene group (compound (6), R_2).

The present invention, however, defines R (and R') as either an hydrogen atom or a group of formula $-M-Y-(Z)_a-(P)_b$. provided that R and R' cannot simultaneously represent H.

In the case a=b=0, M is a spacer arm, and Y is a reactive group:

- Alkyl group ($-CH_2(CH_2)_6CH_3$)

The carbon chain may be considered a spacer arm, but it does not carry any reactive group, thus it does not represent a R group according to the present invention.

- Ethylene glycol chain ($-(CH_2CH_2O)_3-CH_3$)

The ethylene glycol chain is considered a spacer arm, but the terminal oxygen atom is methylated, and thus cannot be considerate as a reactive group. It does not represent an R group according to the present invention.

- 4-methoxybenzaldehyde ($-C_6H_4-OCH_3$)

The phenyl ring may be considered a spacer arm, but the methoxy group cannot be considered a reactive group. It does not represent a R group according to the present invention.

- Pyrene group ($-C_{16}H_9$)

The pyrene aromatic system may be considered a spacer arm, but it does not carry any reactive group, thus it does not represent a R group according to the present invention.

<u>In the case a or b =1, or a = b =1</u> M is a spacer arm, and Y derives from a reactive group, Z is a linker group, and P is an effective group.

- Alkyl group ($-CH_2(CH_2)_6CH_3$).

The carbon chain may be considered a spacer arm, and a CH_2 group may be considered as derivating from a reactive group. But an alkyl group is neither liable to be linked to another molecule, nor be considered as an effective group according to the present invention.

A methyl (or alkyl) group does not induce particular spectroscopic properties, with respect to the alkyl linker arm, or induce biological effects.

Thus, it does not represent a R group according to the present invention.

- Ethylene glycol chain ($-(CH_2CH_2O)_3-CH_3$)

The ethylene glycol chain is considered a spacer arm, and the oxygen atom may be considered as derivating from a reactive group. But the methyl group, is neither liable to be linked to another molecule, nor be considered as an effective group according to the present invention.

A methyl group does not induce particular spectroscopic properties, or induce biological effects.

Thus it does not represent a R group according to the present invention.

- 4-methoxybenzaldehyde ($-C_6H_4-OCH_3$)

The phenyl ring may be considered a spacer arm, and the oxygen atom may be considered as derivating from a reactive group. But the methyl group, is neither liable to be linked to another molecule, nor be considered as an effective group according to the present invention.

A methyl group does not induce particular spectroscopic properties, or induce biological effects.

Thus it does not represent a R group according to the present invention.

- Pyrene group ($-C_{16}H_9$)

The pyrene aromatic system may be considered a spacer arm, but it does not carry any Y group derivated from a reactive group, linker group or effective group.

Thus it does not represent an R group according to the present invention.

None of the compounds disclosed in GEORGAKILAS et al. (JACS 2002) anticipate the functionalized compounds of the present invention. The compounds disclosed in GEORGAKILAS et al. (JACS 2002) cannot be further functionalized.

b) Capping group

Claim 31 is amended and does not recite capping or protecting groups.

The genus where Y is derived from a reactive group (an oxygen atom), and where said Y group is capped or protected by a methyl group, is not subject matter of the present application.

Compound (3) of the document GEORGAKILAS et al. (JACS 2002) is not subject-matter of the present application.

Therefore, GEORGAKILAS et al. (JACS 2002) does not anticipate the claimed invention, and withdrawal of the rejection is respectfully requested.

Double Patenting

Claims 27-29 and 45 were provisionally rejected under 35 U.S.C. §101 as claiming the same invention as that of claims 1-3 and 25 of co-pending Application No. 11/249,328. Claims 30-32 were provisionally rejected on the ground of non-statutory obviousness-type double patenting as being unpatentable over claims 4, 7 and 9 of co-pending Application No. 11/249,328. These rejections are respectfully traversed for the reasons below.

The claims of the patent application 11/249,328 have been modified so as to overcome this rejection.

Amended patent application 11/249,328 claims are now drawn to carbon nanotubes functionalised by X groups representing one or several functional groups, providing when X represents one functional group, said functional group contains several effective groups (P groups).

The present application claims, however, are drawn to carbon nanotubes functionalised by X groups representing a functionalized group, said functionalized group containing 0 or 1 effective group (P group).

Thus, the subject matters of the present application and the subject matter of the application 11/249,328 are neither identical, nor obvious variants, and withdrawal of both of statutory and non-statutory double patenting rejection is respectfully requested.

Claims 30 and 31 were provisionally rejected on the ground of non-statutory obviousness-type double patenting as being unpatentable over claims 34 and 36 of co-pending Application No. 11/628,749. This rejection is respectfully traversed for the reasons below.

The claims of this application have been modified so as to overcome this rejection.

Therefore, withdrawal of the rejection is respectfully requested.

Conclusion

In view of the amendment to the claims and the foregoing remarks, this application is in condition for allowance at the time of the next Official Action. Allowance and passage to issue on that basis is respectfully requested.

Should there be any matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

The Commissioner is hereby authorized in this, concurrent, and future submissions, to charge any deficiency or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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